

# BRACKETS AND METHODS FOR HOLDING WIRES UTILIZING MAGNETIC FORCE

## BACKGROUND

5 The present invention generally relates to wire holding and more particularly to methods and brackets for holding wires utilizing magnetic force.

10 In many applications involving vehicles, farm equipment, and household and industrial applications, one or more electrical wires are routed across a variety of magnetic surfaces of planar and non-planar configurations. The wires can be left dangling in locations where it is impossible and/or undesirable to mount a permanent clip because of moving parts inside, such as on a combine, or when a metal surface may be too thin to support drilled holes or too dense to drill holes for permanent mounting. When pulling a boat trailer or other trailer, wires often are left hanging as the trailer is temporarily wired to the pulling vehicle, and the wires can become tangled or can be damaged by road debris. On truck box frames, the wire routing is  
15 difficult because the frame can be on different levels and the surfaces available for mounting the wire can be non-planar or irregular or may be made up of one or more planes. When one is working on electrical equipment or an electrical system, wires can become tangled or may need to be separated for negative and positive charges or for identification purposes. Christmas lights or other decorative lights on wires are  
20 removed and replaced on a home or other building year after year and current methods involve removing and replacing fasteners each year, which can be time consuming and can result in damage to the home or other building due to repetitive placement and removal of the fasteners, or can leave empty fasteners protruding from the building while the lights are in storage.

25 Therefore, there is a need to have a novel bracket and methods for overcoming the deficiencies in prior manners of holding wires in various applications.

## SUMMARY

30 The present invention solves these needs and other problems in the field of wire holding by providing, in a preferred form, a bracket to facilitate holding and routing of wires on a magnetic surface of a planar or non-planar configuration. The bracket includes a retaining member that has a magnetic attracting end and a retaining end. The retaining member is shaped to accept a wire and hold the wire between the

magnetic attracting end and the retaining end and adjacent to the magnetic surface when the retaining member is held to the magnetic surface by magnetic force at the magnetic attracting end. The retaining member is formed of a plastic material that is flexible to form a plurality of holding shapes to correspond to the magnetic surface of the planar or non-planar configuration. The plastic material is sturdy to retain one of the plurality of holding shapes while holding the wire adjacent to the magnetic surface of the planar or non-planar configuration. In another aspect of the present invention, the bracket includes one or more grooves formed in the retaining member between the magnetic attracting end and the retaining end. The grooves are adapted to engage the wire while holding the wire adjacent to the magnetic surface.

In other aspects of the present invention, a bracket is provided to facilitate holding and routing of wires on a magnetic surface. The bracket includes a retaining member that has a magnetic attracting end and a retaining end. The retaining member is shaped to accept a wire and hold the wire between the magnetic attracting end and the retaining end and adjacent to the magnetic surface when the retaining member is held to the magnetic surface. The retaining member includes a cavity formed in the magnetic attracting end and in a shape and size to slidably receive and fit a first magnetic attractor. When the first magnetic attractor is mounted and retained in the cavity, at least a portion of the first magnetic attractor is accessible outside of the cavity so that the first magnetic attractor holds the retaining member to the magnetic surface using magnetic force. In another aspect of the present invention, the bracket also includes a second magnetic attractor on the retaining end of the retaining member to cooperate with the magnetic attracting end to hold the retaining member to the magnetic surface for applications where additional magnetic force is required.

In other aspects of the present invention, a bracket is provided to facilitate holding and routing of wires on a magnetic surface. The bracket includes a retaining member that has a magnetic attracting end and a retaining end. The retaining member is shaped to accept a wire and hold the wire between the magnetic attracting end and the retaining end and adjacent to the magnetic surface when the retaining member is held to the magnetic surface. The retaining member has an axis that extends between the magnetic attracting end and the retaining end. The magnetic attracting end includes a first magnetic attractor that is adapted to attach the retaining member to the

magnetic surface. The first magnetic attractor has a length that is longer than a width and has an elongated magnetic force. The length and the elongated magnetic force of the first magnetic attractor are generally perpendicular to the axis of the retaining member. In another aspect of the present invention, the bracket includes a second  
5 magnetic attractor, which is attached to the retaining end of the retaining member and in one form, both the first and second magnetic attractors have lengths that are longer than the widths and elongated magnetic forces that are generally perpendicular to the axis of the retaining member.

In other aspects of the present invention, a bracket is provided to facilitate  
10 holding and routing of wires on a magnetic surface. The bracket includes a retaining member that has a magnetic attracting end and a retaining end. The retaining member is shaped to accept a wire and hold the wire between the magnetic attracting end and the retaining end and adjacent to the magnetic surface when the retaining member is held to the magnetic surface. The retaining member includes a first magnetic attractor  
15 attached to the magnetic attracting end and a second magnetic attractor attached to the retaining end. The first magnetic attractor is of a size different than the second magnetic attractor and both the first and second magnetic attractors are adapted to hold the retaining member to the magnetic surface.

In other aspects of the present invention, a wire is held and routed on a  
20 nonmagnetic surface by attaching a first magnet attractive fastener to the nonmagnetic surface. The wire is placed adjacent to the nonmagnetic surface and to the first magnet attractive fastener that is attached to the nonmagnetic surface. While constraining the wire within a bracket, the bracket is magnetically attached to the first magnet attractive fastener that is attached to the nonmagnetic surface and the wire is  
25 thereby held adjacent the nonmagnetic surface. The bracket is later removed from the first magnet attractive fastener, with the first magnet attractive fastener remaining attached to the nonmagnetic surface. Removing the bracket allows for removing the wire from adjacent the nonmagnetic surface and for storing of both the removed bracket and the removed wire for future reuse. At a later time, the stored wire is  
30 replaced adjacent to the nonmagnetic surface and to the first magnet attractive fastener that is still attached to the nonmagnetic surface. While constraining the replaced wire within the bracket, the bracket is magnetically reattached to the first magnet attractive

fastener attached to the nonmagnetic surface to hold the wire adjacent to the nonmagnetic surface. In another aspect of the present invention, the methods include attaching a second magnet attractive fastener to the nonmagnetic surface spaced at a distance from the first magnet attractive fastener to allow for magnetically attaching and reattaching a bracket that includes more than one magnetic attractor. The first  
5 magnetic attractor of the bracket is magnetically attached to the first magnet attractive fastener and the second magnetic attractor is magnetically attached to the second magnet attractive fastener to constrain the wire within the bracket and hold the wire adjacent the nonmagnetic surface.

10 It is thus an object of the present invention to provide novel methods and brackets for holding wires adjacent to a magnetic surface.

It is yet another object of the present invention to provide such novel methods and brackets for holding wires in locations where it is impossible and/or undesirable to mount a permanent clip because of moving parts inside, such as on a combine.

15 It is yet another object of the present invention to provide such novel methods and brackets for holding wires adjacent to a metal surface which may be too thin to support drilled holes or too dense to drill holes for permanent mounting.

It is yet another object of the present invention to provide such novel brackets that are flexible to fit into a plurality of holding shapes to fit on one of the many  
20 different magnetic surfaces of planar or non-planar configurations.

It is yet another object of the present invention to provide such novel brackets that retain a holding shape while securely holding the wire adjacent to the magnetic surface of the planar or non-planar configuration.

It is yet another object of the present invention to provide such novel brackets  
25 that have the magnetic attractors mounted and retained inside a cavity that is formed in each end of the retaining member to allow for a strong connection of the magnetic attractor to the retaining member, a strong attachment of the magnetic attractor to the magnetic surface, and a facilitating of manufacture and assembly.

It is yet another object of the present invention to provide such novel brackets  
30 that have an elongated magnetic force generally parallel to the wire, to hold the wire securely and prevent tipping of the bracket when there is stress applied, for example, when the wires are routed around corners or running an irregular path.

It is yet another object of the present invention to provide such novel brackets that have ends with magnetic attractors of different sizes to furnish different magnetic forces at each end or to adapt to irregular mounting surfaces.

5 It is yet another object of the present invention to provide such novel brackets that have at least one groove to engage at least one wire and hold the wire adjacent to the magnetic surface when the bracket is held to the magnetic surface.

It is yet another object of the present invention to provide such novel brackets that are easily installed and removed and that are moveable and reusable to adapt to new configurations of the wire routing and to facilitate the organization and separation  
10 of wires during the wiring process and during maintenance or repairs.

It is yet another object of the present invention to provide such novel methods and brackets to magnetically hold wires adjacent to a nonmagnetic surface while allowing for ease in removal and future reuse of the wires and/or bracket.

These and further objects and advantages of the present invention will become  
15 clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

#### DESCRIPTION OF THE DRAWINGS

The illustrative embodiments may best be described by reference to the accompanying drawings where:

20 Figure 1 shows a perspective view of a bracket for holding wires utilizing magnetic force according to the preferred teachings of the present invention.

Figure 2 shows a cross sectional view of the bracket of Figure 1 utilized in methods according to the preferred teachings of the present invention.

Figure 3 shows an exploded perspective view of an alternate embodiment of a  
25 bracket for holding wires utilizing magnetic force and utilized in methods according to the preferred teachings of the present invention.

Figure 4 shows a perspective view of a bracket for holding wires utilizing magnetic force and utilized in methods according to the preferred teachings of the present invention.

30 Figure 5 shows a perspective view of an alternate embodiment of a bracket for holding wires utilizing magnetic force according to the preferred teachings of the present invention.

All figures are drawn for ease of explanation of the basic teachings of the present invention only; the extensions of the figures with respect to number, position, relationship, and dimensions of the parts to form the preferred embodiments will be explained or will be within the skill of the art after the following description has been read and understood. Further, the exact dimensions and dimensional proportions to conform to specific force, weight, strength, flexibility, sturdiness, and similar requirements will likewise be within the skill of the art after the following description has been read and understood.

Where used in the various figures of the drawings, the same numerals designate the same or similar parts. Furthermore, when the terms "surface," "end," "first," "second," "axis," "length," "width," and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawings as it would appear to a person viewing the drawings and are utilized only to facilitate describing the illustrative embodiments.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Brackets for holding wires adjacent to a magnetic surface utilizing magnetic force, constructed and utilized in methods according to the preferred teachings of the present invention, are shown in the drawings and generally designated 10. The magnetic surface 15 could be of a variety of forms including, but not limited to, metal, paneled metal, plastic coated metal, continuous or non-continuous, or planar or non-planar. Examples of continuous magnetic surfaces 15 are railings, steel siding and steel rain gutters on a house, and examples of non-continuous magnetic surfaces 15 are nails or similar magnet attractive fasteners 22 and 24 added to a nonmetal surface such as shown in Figure 3, and a generally nonmetal surface with metal elements embedded or attached. An example of a planar magnetic surface 15 is sheet metal or the like. Examples of a non-planar magnetic surfaces 15 are non-planar configurations such as the inside of an L shaped corner, a truck box frame where the frame is on different levels, a cylindrical object such as a tank such as illustrated in Figure 2, and nails or similar magnet attracting fasteners on surfaces that are at angles other than 180 degrees to each other.

The bracket 10 of the present invention includes a retaining member 14 with a magnetic attracting end 16 and a retaining end 18. The retaining member 14 is shaped

to accept a wire 12 between the magnetic attracting end 16 and the retaining end 18 to hold the wire 12 adjacent to the magnetic surface 15. According to the preferred teachings of the present invention, the retaining member 14 has an arcuate shape to accommodate the wire 12 between the magnetic attracting end 16 and the retaining end 18. According to the preferred teachings of the present invention, the bracket 10 has a first magnetic attractor 36 attached to the magnetic attracting end 16 and a second magnetic attractor 38 attached to the retaining end 18. In preferred forms, the first and second magnetic attractors 36 and 38 cooperate to provide magnetic force at both ends of the retaining member 14 to hold the wire 12 adjacent to the magnetic surface 15. It should be appreciated that such an arrangement allows the retaining member 14 to be held securely to the magnetic surface 15 to hold the wire 12 adjacent to the magnetic surface 15.

According to the preferred teachings of the present invention, the retaining member 14 has a mounting surface 50 that is in contact with the magnetic surface 15 when the retaining member 14 is held to the magnetic surface 15 by magnetic force. A cavity 46 is formed in the retaining member 14 at both the magnetic attracting end 16 and the retaining end 18 in preferred forms shown. The cavities 46 have a shape and a size to slidably receive and fit the first and second magnetic attractors 36 and 38, respectively. In the preferred form, the cavities 46 are formed in the mounting surface 50 of the retaining member 14, and the first and second magnetic attractors 36 and 38 are mounted and retained within the cavities 46. In most preferred forms, at least a portion of the first and second magnetic attractors 36 and 38 are accessible outside of the cavities 46 on the mounting surface 50 of the retaining member 14. It can be appreciated that such an arrangement allows for a strong connection of the magnetic attractors 36 and 38 to the retaining member 14, a strong attachment of the magnetic attractors 36 and 38 to the magnetic surface 15, and a facilitating of manufacture and assembly.

In most preferred forms, the magnetic attractors 36 and 38 are secured in the cavities 46 of the retaining member 14 by an adhesive 30. In an alternative form according to the preferred teachings of the present invention, the magnetic attractors 38 and/or 36 are secured by a friction fit within cavities 46. In most preferred aspects and especially when friction fit, bleed ports 48 can be provided to allow escape of air

and thereby preventing trapping of air within cavities 46 during insertion of magnetic attractors 38 and/or 36. Although shown extending from cavities 46 in a direction opposite to mounting surface 50 in Figure 3, bleed ports 48 can have different orientations, forms, and the like according to the teachings of the present invention.

5 In still a further alternative form according to the teachings of the present invention, the magnetic attractors 38 and/or 36 are mounted directly to the retaining end 18 and/or the magnetic attracting end 16 as shown in Figure 5, respectively, by the adhesive 30 with no cavities 46 being formed in the retaining member 14. According to the teachings of the present invention, the magnetic attractors 36 and 38 could be  
10 secured to the retaining member 14 in other manners. As an example, the magnetic attractors 36 and 38 could be secured by fasteners in conjunction with, or instead of, the adhesive 30.

In preferred forms according to the preferred teachings of the present invention, the first and second magnetic attractors 36 and 38 are magnets. In a  
15 preferred form shown in Figure 4, the magnets have lengths longer than widths to provide elongated magnetic attractors 36 and 38 on both ends of the retaining member 14. The lengths of the magnets are generally perpendicular to an axis that extends between the magnetic attracting end 16 and the retaining end 18 of the retaining member 14 to provide an elongated magnetic force. The elongated magnetic force  
20 prevents the retaining member 14 from tipping when there is stress applied, for example, when the wire 12 is routed around corners or running an irregular path. In the preferred form shown in Figure 4 according to the preferred teachings of the present invention, the magnetic attractors 36 and 38 are magnets that have rectangular cross sections with lengths that are perpendicular to the axis of the retaining member  
25 14. In further aspects of the invention, the bracket 10 includes the second magnetic attractor 38 of a size different than the first magnetic attractor 36, as shown in Figure 3, to furnish different magnetic forces at each end or to adapt to irregular magnetic surfaces 15. As will be recognized by those skilled in the art, alternate magnetic attractors 36 and 38 could be used to provide the elongated magnetic force, including  
30 but not limited to, other shapes of magnets, magnetic attractors 36 and 38 including two or more magnets each as shown in Figure 5, or the like, without departing from the spirit or scope of the present invention.



In the preferred form, the magnetic attractors 36 and 38 are located on the mounting surface 50 of the retaining member 14 and contact the magnetic surface 15 when the retaining member 14 is held to the magnetic surface 15 by magnetic force. Locating the magnetic attractors 36 and 38 on the mounting surface 50 allows for optimum magnetic force due to proximity of the magnetic attractors 36 and 38 and the magnetic surface 15. However as will be recognized by those skilled in the art, alternate locations of the magnetic attractors 36 and 38, such as imbedded within the retaining member 14 or on an opposite side of the retaining member 14 from the mounting surface 50, may be used without departing from the spirit or scope of the present invention.

In an alternative form shown in Figure 5 according to the preferred teachings of the present invention, the bracket 10 has only the first magnetic attractor 36 attached to the magnetic attracting end 16. The first magnetic attractor 36 cooperates with the retaining end 18 to allow the retaining member 14 to hold the wire 12 while mounted on a narrow magnetic surface 15, such as a strip of sheet metal, or where the magnetic surface 15 is uneven.

According to the preferred teachings of the present invention, the retaining member 14 is formed of a plastic material such as, but not limited to, a copolymer polypropylene, that is flexible to form a plurality of holding shapes to correspond to the magnetic surface 15 of a planar or non-planar configuration. For example, the retaining member 14 may adapt to the magnetic surface 15 that is planar such as sheet metal, or the magnetic surface 15 that is non-planar such as the inside of an L shaped corner, the truck box frame where the frame is on different levels, the cylindrical object such as a tank as shown in Figure 2, or nails on nonmetal surfaces that are at angles other than 180 degrees, such as at a right angle, to each other. According to the preferred teachings of the present invention, the plastic material is sturdy to retain one of the plurality of holding shapes while holding the wire 12 adjacent to the magnetic surface 15 of the planar or non-planar configuration. It should be appreciated that such a construction allows for the retaining member 14 to adapt to the magnetic surface 15 of the planar or non-planar configuration, yet still hold the wire 12 securely on the magnetic surface 15.

According to the preferred teachings of the present invention, a plurality of grooves 42 are formed in the retaining member 14 between the magnetic attracting end 16 and the retaining end 18. The grooves 42 are adapted to engage the wires 12 when the wires 12 are held between the retaining member 14 and the magnetic surface 15. In other aspects of the present invention, the bracket 10 has a single groove 42 formed in the retaining member 14 to engage a wire 12 between the magnetic attracting end 16 and the retaining end 18 of the retaining member 14 and adjacent to the magnetic surface 15.

In other aspects of the present invention according to the preferred teachings, methods are provided to facilitate holding and routing of wires 12 on a nonmagnetic surface by altering the nonmagnetic surface to provide the magnetic surface 15 of a non-continuous configuration on which to attach the magnetic bracket 10. According to the preferred teachings and as shown in Figure 3, the methods include attaching first and second magnet attractive fasteners 22 and 24 to the nonmagnetic surface with the second magnet attractive fastener 24 spaced from the first magnet attractive fastener 22 to correspond to a spacing between the first magnetic attractor 36 and the second magnetic attractor 38 of the bracket 10. In the preferred form, attaching the first and second magnet attractive fasteners 22 and 24 includes, but is not limited to, driving a nail and a second nail into a wooden surface, such as a building. The wire 12 can be placed adjacent to the first and second magnet attractive fasteners 22 and 24 and to the nonmagnetic surface. The wire 12 is constrained within the bracket 10 and held adjacent to the magnetic surface 15 of the non-continuous configuration when the first magnetic attractor 36 is magnetically attached to the first magnet attractive fastener 22 and the second magnetic attractor 38 is magnetically attached to the second magnet attractive fastener 24.

According to the preferred teachings of the present invention, the bracket 10 can be easily removed from the first and second magnet attractive fasteners 22 and 24, with the first and second magnet attractive fasteners 22 and 24 remaining attached to the nonmagnetic surface for future reuse. Removing the bracket 10 allows for the removal of the wire 12 and for storing of the removed bracket 10 and the removed wire 12. The stored wire 12 can be replaced adjacent to the nonmagnetic surface and to the first and second magnet attractive fasteners 22 and 24 that are still attached to

the nonmagnetic surface. The bracket 10 can be magnetically reattached to the first and second magnet attractive fasteners 22 and 24 to constrain the replaced wire 12 and to hold the replaced wire 12 adjacent to the magnetic surface 15 of the non-continuous configuration. It can be appreciated that such methods allow for temporary display of  
5 wired Christmas lights, or the like, with ease of removing them for off-season storage, and with a simple way to hang them again the following year, as the first and second magnet attractive fasteners 22 and 24 are already in place and the bracket 10 is easily attached to the first and second magnet attractive fasteners 22 and 24 by magnetic force to again display the wired Christmas lights adjacent to the nonmagnetic surface.

10 In other aspects of the invention the methods include attaching only the first magnet attractive fastener 22 to the nonmagnetic surface to provide the magnetic surface 15 of the non-continuous configuration to allow attachment of the bracket 10 including only the first magnetic attractor 36. As will be recognized by those skilled in the art, the methods of the present invention allow for the use of other magnetic  
15 brackets than the bracket 10 without departing from the spirit or scope of the present invention.

Now that the basic teachings of the present invention have been explained, many extensions and variations will be obvious to one having ordinary skill in the art. For example, although the bracket 10 according to the preferred teachings of the  
20 present invention has been shown as including several features in combination believed to produce synergistic results, such features can be utilized singly and in other combinations with other features according to the teachings of the present invention.

Furthermore, although the retaining member 14 shown in the most preferred  
25 form includes the magnetic attracting end 16 and the retaining end 18 being at opposite ends and on the mounting surface 50 that contacts the magnetic surface 15, it can be appreciated that the retaining member 14 and its ends 16 and 18 could be of different forms, sizes, shapes and orientations than shown and to each other according to the teachings of the present invention.

30 Similarly, while in the preferred form according to the preferred teachings of the present invention, the retaining member 14 is formed of the plastic material, such as copolymer polypropylene, which is believed to be advantageous for many reasons

including its ability to withstand environmental conditions such as heat, cold, dirt and liquids, the retaining member 14 could be formed from other materials that have similar flexibility and sturdiness characteristics according to the teachings of the present invention.

5           Likewise, while in the most preferred form according to the preferred teachings of the present invention, the magnetic attractors 36 and 38 are magnets, such as, but not limited to, neodymium nickel plated magnets or stainless steel magnets, which are believed to be advantageous for many reasons including resistance to rust, the magnetic attractors 36 and 38 could be formed from other magnetic  
10   attracting material according to the teachings of the present invention.

          Thus since the invention disclosed herein may be embodied in other specific forms without departing from the spirit of general characteristics thereof, some of which forms have been indicated, the embodiments described herein are to be considered in all respects illustrative and not restrictive. The scope of the invention is  
15   to be indicated by the appended claims, rather than by the foregoing description, and all changes which come within the meaning and ranges of equivalency of the claims are intended to be embraced therein.